(MaxY) and a minimum value (MinY) of quantized data of Y in key values, and a maximum value (MaxZ) and a minimum value (MinZ) of quantized data of Z in key values. If the maximum values (Max, that is, MaxX, MaxY, MaxZ) and minimum values (Min, that is, MinX, MinY, MinZ) are input, it is determined whether or not the absolute values of the minimum values (Min) are less than or equal to the maximum values (Max) in step 4325. If the result indicates that the minimum values (Min) are less than or equal to the maximum values (Max), the quantization steps of encoding bits (Qstep, that is, Qstep_X, Qstep_Y, Qstep_Z) are set as $\mathrm{int}\{(\log_2 \mathrm{Max}) + 1\}$ and otherwise the quantization steps of encoding bits (Qstep) are set as $\mathrm{int}\{(\log_2 |\mathrm{Min}|) + 1\}$. Thus, the quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z) of quantized data of X, Y, Z coordinates are obtained, and the quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z) are output from the quantization step generator 4322 of FIG. 20.

REMARKS

In reviewing the specification, Applicants noted apparent error due to a computer malfunction in that some unusual characters were simply not printed. Hence, this Second Preliminary Amendment inserts the appropriate characters at the appropriate locations. Support for the changes can be found in the drawings being described in the text that is being been amended by the above.

In light of the foregoing, Applicants respectfully request favorable action on the merits.

Respectfully submitted,

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Paragraph beginning at Page 10, line 17

Thus, position values of vertices to be encoded in the encoding apparatus 200 are converted to differential values in order to remove spatiotemporal data redundancy, and input to the quantization unit 230. The quantization unit 230 adjusts the expression precision degree of key value data with respect to quantization size values so as to provide actual data compression effects in step 2300. Quantized result values [( )] $\underline{(Q^{K}, Q^{KV})}$ are input to both the ADPCM processing unit 220 and the entropy encoding unit 235. The entropy encoding unit 235 removes bit redundancy in the quantized values, using the probability of bit symbol occurrence, and generates a final bit stream 240 in step 2350.

Paragraph beginning at Page 11, line 11

FIG. 6 is a detailed block diagram of a preferred embodiment of the ADPCM processing unit 220 of FIG. 3. Referring to FIG. 6, the ADPCM processing unit 220 includes a differential value generator 221, a predictor 222, a multiplexer 223, a DPCM processor 228 for keys, and a DPCM processor 229 for key values. The differential value generator 221 defines differential values [( )] $\underline{(}\ \underline{Q^{KV}_{x(v,k)}},\ \underline{Q^{KV}_{y(v,k)}},\ \underline{Q^{KV}_{z(v,k)}}\ \underline{)}$ among all position values, which are obtained when an arbitrary vertex changes in time.

Paragraph beginning at Page 12, line 8

FIG. 9 illustrates a prediction method for extracting data redundancy of the predictor of FIG. 6. Referring to FIG. 9, the predictor 222 first visits vertices according to the BFS search order defined in the vertex connectivity processing unit 215, and defines a vertex (v) adjacent to the visited i-Th vertex in step 2221. A vertex having high spatial correlation with the vertex (v)

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searched for in step 2221 is defined as a top vertex b in the BFS search order in step 2222. Then, the differential values [( )] ($\underline{Q^{KV}_{x(v,k)}}$, $\underline{Q^{KV}_{y(v,k)}}$, $\underline{Q^{KV}_{z(v,k)}}$) of 3D space position values of two vertex b and having high spatial correlation and defined in steps 2221 and 2222, respectively, are calculated to remove spatial data redundancy in step 2225.

Paragraph beginning at Page 12, line 17

At this time, a differential value which is input through the differential value generator 221 is used, without change, as a vertex which is first visited according to the BFS search order. In step 2226, a maximum value and a minimum value (Max, Min) of each component are defined from the differential values [( )] ($\underline{Q^{KV}_{x(v,k)}}$, $\underline{Q^{KV}_{y(v,k)}}$, $\underline{Q^{KV}_{z(v,k)}}$) space position values obtained in step 2225. The maximum values and minimum values are input to the quantization unit 230, and are used in a normalization process which is needed for quantization.

Paragraph bridging pages 17 and 18

The ADPCM processing unit 420 receives BFS information generated in the vertex connectivity processing unit 415, and keys (Q^K) and key values (Q^{KV}) corresponding to the CI node and Coord information of the IFS node provided by the demultiplexer 410. Then, the ADPCM processing unit 420 generates each differential value (E^K, E^{KV}) of keys, of which temporal data redundancy is to be removed, and key values, of which spatiotemporal data redundancy is to be removed, to the quantization unit 430. The quantization unit 430 compresses data by adjusting the expression precision degree of key value data with respect to the quantization size value. Quantized result values [( )] ($\underline{\hat{E}^{KV}}$) are input to both the ADPCM processing unit 420 and the entropy encoding unit 435. In response to the quantized result values [( )] ($\underline{\hat{E}^{KV}}$), the encoding

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bit generating unit 432 generates the quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z).The generated quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z) are input to the entropy encoding unit 435. In response to the quantization steps (Qstep_X, Qstep_Y, Qstep_Z), the entropy encoding unit 435 removes bit redundancy in the quantized values [( )] ($\hat{E}^{KV}$), using the probability of bit symbol occurrence, and forms a final bit stream (Compressed Bit Stream) 440.

Paragraph bridging Pages 20 and 21

FIG. 21 is a flowchart for explaining an quantization step calculation method which is performed by the quantization step generator of FIG. 20. Referring to FIG. 21, the method for calculating quantization steps according to the present invention first receives a maximum value (MaxX) and a minimum value (MinX) of quantized data of X in key values, a maximum value (MaxY) and a minimum value (MinY) of quantized data of Y in key values, and a maximum value (MaxZ) and a minimum value (MinZ) of quantized data of Z in key values[,]. If the maximum values (Max, that is, MaxX, MaxY, MaxZ) and minimum values (Min, that is, MinX, MinY, MinZ) are input, it is determined whether or not the absolute values of the minimum values (Min) are less than or equal to the maximum values (Max) in step 4325. If the result indicates that the minimum values (Min) are less than or equal to the maximum vlaues (Max), the quantization steps of encoding bits (Qstep, that is, Qstep_X, Qstep_Y, Qstep_Z) are set as [ ] $\text{int}\{(\log_2 \text{Max}) + 1\}$ and otherwise the quantization steps of encoding bits (Qstep) are set as [ ] $\text{int}\{(\log_2 |\text{Min}|) + 1\}$. Thus, the quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z) of quantized data of X, Y, Z coordinates are obtained, and the quantization steps of encoding bits (Qstep_X, Qstep_Y, Qstep_Z) are output from the quantization step generator 4322 of FIG. 20.